DOCUMENT RESUME

ED 291 931 CE 049 783

TITLE	Transportation Systems. Grades 9-10. Course #8126 (Semester). Technology Education Course Guide. Industrial Arts/Technology Education.
INSTITUTION	North Carolina State Dept. of Public Instruction, Raleigh. Div. of Vocational Education.
PUB DATE	88
NOTE	73p.; For related documents, see CE 049 780-794.
PUB TYPE	Guides - Classroom Use - Guides (For Teachers) (052)
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	Behavioral Objectives; Grade 9; Grade 10; High Schools; *Industrial Arts; Learning Activities; Learning Modules; Lesson Plans; *Power Technology; State Curriculum Guides; *Systems Analysis; *Systems Approach; Technological Literacy; *Transportation
IDENTIFIERS	North Carolina

ABSTRACT

This guide is intended for use in teaching a course in transportation systems. The course, which has been designed for students in grades 9 and 10, is intended to provide a basic understanding of transportation systems and the role of energy systems in transportation. The first two sections discuss the guide's development within the framework of North Carolina's efforts to improve technological literacy and the guide's place as part of an instructional system. A list of the course's major objectives and a course outline are provided next. The remainder of the guide consists of learning modules on the following topics: the evolution and main types of transportation; the concept of a transportation system; land, water, air, and space transportation systems; energy systems; and the relationship between transportation and society. Each module includes information about the length of time needed to complete the module, an introduction to the instructional content to be covered in class, performance objectives, a day-by-day outline of student learning activities, and lists of suggested textbooks and references. (MN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

TECHNOLOGY EDUCATION
COURSE GUIDE

INDUSTRIAL ARTS/TECHNOLOGY EDUCATION

DIVISION OF VOCATIONAL EDUCATION
STATE DEPARTMENT OF PUBLIC INSTRUCTION
RALEIGH, NORTH CAROLINA 27603-1712
1988

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

E Brunstrom

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

TRANSPORTATION SYSTEMS

GRADES 9-10

COURSE #8126
(SEMESTER)

BEST COPY AVAILABLE

Activities and procedures within the Division of Vocational Education are governed by the philosophy of simple fairness to all. Therefore, the policy of the Division is that all operations will be performed without regard to race, sex, color, national origin, or handicap.

IF THERE ARE ANY QUESTIONS, PLEASE CONTACT THE INDUSTRIAL ARTS/TECHNOLOGY EDUCATION OFFICE BY MAIL (116 WEST EDENTON STREET, EDUCATION BUILDING, RALEIGH, NC 27603-1712) OR BY PHONE (919/733-7970).

ACKNOWLEDGEMENTS

The North Carolina Technology Education Curriculum is the product of a curriculum redirection process begun in the early seventies. As in any change process, many individuals have contributed their time and energies to provide North Carolina students with a curriculum designed to meet their needs to be technologically literate adult citizens. The following are recognized for their vision and leadership in setting the direction for Technology Education in North Carolina schools.

Members of the N.C. Curriculum Study Taskforce who charted the course for technology education in North Carolina schools. Their study report and recommendations provided the direction for a change in the identity of the discipline and a total redirection of the curriculum.

Members of the N.C. Curriculum Committee who validated the Technology Education Curriculum Guide as appropriate study for assisting students in understanding technological systems impacting on their lives. Further, industry representatives of the committee verified the appropriateness of suggested activities reflective of practices in construction, communications, manufacturing, and transportation.

N.C. Technology Education Association who provided a forum for redirection of the discipline. It was the association that led the profession in changing identity to technology education. The association also provided opportunities for professionals to develop competence in the classroom delivery of technology education through the sponsorship of in-service programs.

Individual technology education professionals who gave leadership to other professionals in the curriculum change process. These professional leaders piloted many technology education activities in their classrooms and served as role models for other professionals.

Members of the N.C. Council of Technology Teacher Educators who provided insite and support throughout the curriculum redirection process.

Indiana curriculum developers who provided curriculum materials adopted and adapted for North Carolina Technology Education programs.

INTRODUCTION

The North Carolina Technology Education Curriculum is a program to meet every citizen's need to be technologically literate. Some basic assumptions underlie the program, and these can be divided into content assumptions, and learner assumptions.

The curriculum was developed using the belief that the appropriate content for the field is technology, and its impact on individuals and society. It was further assumed that the content is best organized around human productive systems that have been used, are now being used, and will, most likely, continue to be used. These universal systems are communication, construction, manufacturing, and transportation. Finally, it was assumed that this content can best be addressed from a systems approach with its inputs, processes, outputs, feedback, and goals/restraints.

The curriculum was further based on the assumption that education should meet the needs of individuals and the human requirements of society. It was assumed that each person living in a technological society should have a basic understanding of and the ability to assimilate the knowledge about technology. People it was assumed, should be able to interact with the technological nature of society and help impact the type of future new technologies can provide. Additionally people should be able to be contributors to a society in their several roles, including citizen, voter, investor, consumer, worker, and leader.

These assumptions caused the curriculum to be developed in such a way as to:

1. Provide an overview of technology first, allow for more indepth study in specific technological areas, and culminate with synthesis activities.

2. Be more teacher-directed, content-centered in early courses, and highly, student-directed, process centered in advanced courses.

3. Involve problem-solving and group activities of all courses.

4. Stress the how and why of technology and its relationship to our quality of life.

5. Be activity-centered learning, with the content being used to determine the appropriateness of each activity selected.

6. Be equally important to young women and young men, both of which must function in a technological society.

Finally, the curriculum was developed to be descriptive rather than prescriptive. The materials describe what to teach and suggest ways of teaching the content. At no time are daily activities prescribed in such a way to preclude individualizing the presentations to meet local conditions.

THE CURRICULUM GUIDE IN AN INSTRUCTIONAL SYSTEM

Each course in the North Carolina Technology Education Curriculum is seen as a dynamic activity involving a complete instruction system. This system generally includes seven components: the teacher, the students, a texbook when available, the curriculum guide, laboratory sheets, apparatus, and a reference library.

THE TEACHER

The teacher plays the primary role in the system. This role entails being a curriculum developer. The teacher chooses the points to emphasize and to evaluate. Care should be taken to insure that the coverage of the subject is comprehensive. You should resist "picking and choosing" only modules and activities that are the most interesting, most familiar, or the easiest to implement. All modules and activities should be included. However, you are encouraged to redesign or replace activities with your own activities that contain equivalent content.

As a technical expert, the teacher gives presentations, demonstrations, and asks questions about the subject matter. Safety information, and the demonstration of teaching/learining activities, are the responsibility of the teacher.

The teacher is an instruction manager. Managers plan, schedule, direct, and control activities. The teacher, perhaps in cooperation with students, plan the instruction by identifying the instructional goals. The activities to reach these goals are scheduled. Through presentations and application activities students are directed through the construction activities. Finally, the student's work and the teacher's management is controlled through various forms of evaluation. Since evaluation instruments should be designed to measure success in reaching the goals, these instruments should be prepared by the teacher.

The teacher is the creator of the teaching/learning environment. It is highly recommended that you create a "role playing" environment. In addition to having students do tasks that simulate construction, have them play the role of workers, managers, and owners. For example, refer to a group of students as a "work crew" or "survey party" with job titles, rather than as students who carry out assigned tasks. Help them visualize themselves in their roles. The teacher can become a job superintendent, owner, or government officer, who approves the "work crew's" job.

THE STUDENT

The target population is made up of middle-junior high or high school students. The students will often work in groups of from three to five. Their responsibilities include reading the textbook assignments, doing the worksheets as homework, and completing the activities.

THE TEXBOOK

A textbook should be selected for the course and each student should have one. A textbook contains the body of knowledge about industrial technology. It should be selected to meet the appropriate reading level, and be written in an interesting way with numerous illustrations.

THE CURRICULUM GUIDE

The curriculum guide is to be used to help plan your instruction. The introduction consists of a structure for the content and a description of an instructional system with suggestions on how to use it.

The remainder of the curriculum guide briefly describes the modules. Each module consists of an introduction, objective(s), and a description of the activities. The description of the activities includes a schedule, presentation titles, application activities, and presentation titles, references, and safety guidelines. Suggestions for getting prepared and carrying out the activity are found in the teacher activity sections.

Suggestions for a variety of optional activities may also be found throughout the curriculum guide.

THE APPARATUS

Often the course guide contains plans for specialized apparatus useful in teaching the course. Drawings will be placed with the activity in which they are used. You can use the drawings to construct the apparatus.

THE REFERENCE LIBRARY

Some courses require student reference books. The titles of these are included in the reference library and copies should be purchased for laboratory use.

DAILY LESSON PLANS AND EVALUATION

The planning of daily activities and an on going evaluation system are th teacher's responsibility and rightfully so. Each student should adapt activities and presentations to insure they help students develop the identified concepts within local conditions. The curriculum guide was designed to help you, the local professional, present a relevant, exciting course. Good luck!

INTRODUCTION

Transportation is one of the basic human productive activities. Over ages people have developed an ever increasingly complex system to move people and cargo from one location to another. Early developments were restricted to natural routes—animal trails and waterways. More complex land transportation systems followed with rail, roadway, and pipeline systems being developed. Also, shipping systems moved from sail-powered wood craft to steel-hulled craft powered by well-developed power plants. Later air transportation supplemented the land and water systems. We are now using space transportation systems to deliver satellites into orbital positions.

Transportation systems, indeed, are essential for societal development. Commerce is based on fast, efficient movement of goods and people. Many recreational activities depend on the ability to travel to distant locations. Various jobs require people to travel to customers, construction sites, and other points of activity.

Technological literacy requires an understanding of the technical means people use to extend the ability to move themselves and goods to various locations. This course is designed to provide a basic understanding of transportation systems, and energy, as a prime input to all transportation activities. Students will be given the opportunity to view transportation as a system, then investigate the systems used to move people and goods on land and water, and through air and space. Finally, the students will be able to study energy systems as they are applied to transportation and other uses.

OBJECTIVES

Upon completion of this course, each student should understand:

1. Transportation as a system.
2. The principles and practices of land, water, air, and space transportation.
3. Energy utilization as a system.
4. The principles and practices of mechanical, light, electrical, heat, chemical energy utilization systems.
5. The advantages and limitation of various transportation and energy utilization systems.

SUGGESTED RESOURCES

TEXTBOOKS

Bohn, Ralph C., et.al., Energy, Power and Transportation Technology. Peoria, IL: Bennett & McKnight Publishing Co., 1986.

DeOld, Alan R. Everett, Sheets and William, Alexander, Transportation. Worcester, MA: Davis Publications, Inc., 1986.

Karwatka, Dennis and Michael R. Kozak, Energy, Power and Transportation Technology. Orlando, FL: Harcourt Brace Jovanovich, 1987.

OTHER RESOURCES

Booklets from:

U. S. Department of Energy
Technical Information Center
P. O. Box 62
Oak Ridge, TN 37830

Americal Gas Association
Educational Services
1515 Wilson Blvd.
Arlington, VA 22209

Most Major Petroleum Companies

COURSE OUTLINE

Module Number	Title and Content	Time (Days)
1.	Introduction to Transportation What is transportation Types of transportation Evolution of transportation	5
2.	Transportation Systems Transportation as a system System inputs Transportation processes Vehicle systems	12
3.	Land Transportation Systems The land transportation system Evolution of land transportation systems Land transportation vehicles Highway systems Rail systems Pipeline systems Support systems	11
4.	Water Transportation Systems The water transportation system Water transportation vessels Ocean transportation Inland waterway transportation Support systems	9
5.	Air Transportation Systems The air transportation system Aircraft Support systems	10
6.	Space Transportation Systems The space transportation system Space craft Support systems	10
7.	Energy Systems Sources of energy Types of energy Converting energy Transmitting energy Utilizing energy Energy and the environment	20
8.	Transportation & Society	3

MODULE: 1 :'Introduction to Transportation

LENGTH: 4 DAYS Transportation CLUSTER

Transportation systems are essential for all societies. The level of development of these systems will directly influence the standard of living of the citizens in society. Early transportation systems developed along natural trails developed by animals and dry stream beds, and on waterways. These natural environmental features limited the areas where humans could develop settlements.

Later transportation systems became more complex as natural barriers were conquered. Canals were developed which could traverse changes in elevation; roads and railways were built to connect settlements; human flight was made possible; and finally, the reaches of space have been opened up with new exotic transportation systems.

This module is designed to introduce students to the concept of transportation and its historical development. The learning experiences in this module provide the backdrop for the many that will follow in later modules.

OBJECTIVES

Upon completing this learning module, each student should be able to:

1. Define transportation.
2. Describe the importance of transportation to individuals and society.
3. List and describe the four major modes of transportation.

CALENDAR

DAY	ACTIVITY
1	Complete the administrative tasks to start the class.
2	Present the course outline and objectives.
	Present an introduction to transportation.
	Introduce transportation survey.
	Have the student start conducting the transportation survey after school.
3–4	Introduce and show a film that provides a historical background to transportation.
	Introduce a simple laboratory activity.
	Have the students continue to conduct transportation survey after school.
5	Have the students present survey results.

PRESENTING THE MODULE

DAY	ACTIVITY
0	Well before this module is introduced, the following tasks should be completed: 1. Order and preview an appropriate film on the historical development of transportation for day 3. See Appendix for selected titles. 2. Develop a history of transportation survey for Days 2–4. Sample survey instrument is included in the Appendix.
1	Complete the necessary administrative details to start a class.
2	Present a discussion on the "Nature and Scope of the Introduction to Transportation Class". Describe the various areas that will be studied and typical activities which will be completed during the class. BE A CHEERLEADER!!!!!! A slide series showing transportation in the "real world", and the activities planned for the class which will help the students understand transportation, would be an excellent introduction. Present a discussion on "An Introduction to Transportation." This discussion should consider: 1. What is transportation 2. Reasons for transportation 3. Evolution of transportation 4. Types of transportation — land, water, air, space. Distribute the historical development of transportation survey and explain its use. (See Appendix)
2–4	After school, administer the "History of Transportation" survey to at least: 1. One teenager 2. One young adult (age 21-35) 3. One middle-aged adult (40-55) 4. One senior citizen (over 65).

DAY	ACTIVITY
3–4	Introduce and show the film selected to provide a historical overview of transportation. Provide the students a list of events to look for or a worksheet designed around the film. Introduce and have the students complete a simple transportation laboratory activity such as: "Using simple hand tools and scrap materials, develop a transportation which will move an item from one point to another." (See Appendix.)
5	Record the results from the historical survey. Use a large piece of paper to record and summarize the data. Invite an elderly person to come to class and discuss changes in transportation in their lifetime. Summarize this introduction to transportation.

BIBLIOGRAPHY

TEXTBOOKS

Bohn, Ralph C., et.al., Energy, Power and Transportation. Bennett and McKnight Publishing Co., 1986, pp. 158-172.

DeOld, Alan R., Everett, Sheets, and Alexander, William., Transportation. Davis Publications, Inc., 1986, pp. 2-26.

Karwarka, Dennis and Michael, R. Kozak, Energy, Power and Transportation. Harcourt Brace Jovanovick, Publishers, 1987, pp. 222-237.

FILMS

Transportation Around the World

11 Minutes. Film # 3304 Rental: $8.50

Relates geographical differences in various locations to the forms of travel used. Illustrates land, water, and air transportation. Shows llamas in the Andes, Kayaks in the Artic, electric trains in Japan, and helicopters in the United States.

Transportation Revolution: Story of America's Growth

20 Minutes. Film # 9202 Rental: $13.50

Presents a brief historical overview of the development of railroads, automobiles, and airplanes in the United States. Includes historical film clips of each mode of transportation and comments on the need for combating pollution caused by transportation systems.

(These films are available from the Bureau of AudioVisual Instruction, Box 2093, Madison, WI 53701, (608)262-1644.

APPENDIX

SCHOOL

Name _____ Period _____

Ask people in each of the following categories if they have used the types of transportation listed in the left column as a main mode of getting from one place to another. Disregard events like hayrides, camps, etc. Place a + if they have. Leave the square blank if they have not.

TYPE OF TRANSPORTATION	Teenage	Young Adult	Middle Age	Senior Citizen
Horse				
Horse & buggy or wagon				
Stick-shift automobile				
Automatic transmission Automobile				
Pickup truck				
Over-the-road (large) truck				
Steam-powered train				
Diesel-powered train				
Piston engine airplane				
Jet aircraft				
Steamship				
Sailboat				
Paddlewheel riverboat				

Transportation Problem-Solving Activity

1. Divide the class into groups of 2-3 students. Note: This activity can also be done by students working individually.

2 Assign each group the following three assignments, one at a time:

Design a guidance system which will allow the vehicle— system which will allow the vehicle (golf ball) to move from Point A to Point B. The points should be located about 3-4 feet apart on a table or workbench. A simple solution is shown in Figure 1.

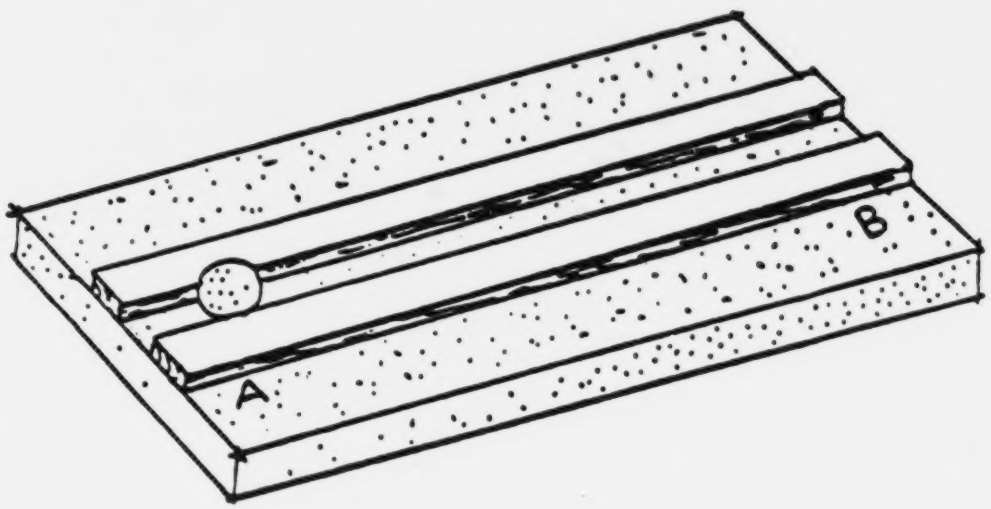


FIGURE 1: One solution to the Point A to Point B assignment

Design a guidance system which will insure that the vehicle (golf ball) will travel from Point A to Point C, passing through Point B. The points should be located on a table or bench top so that the ball must make a 45-90 degree turn at Point B. Figure 2 shows a simple solution to the design assignment.

Reprinted by permission from the Center for Implementing Technology Education, Ball State University, Muncie, IN 47306.

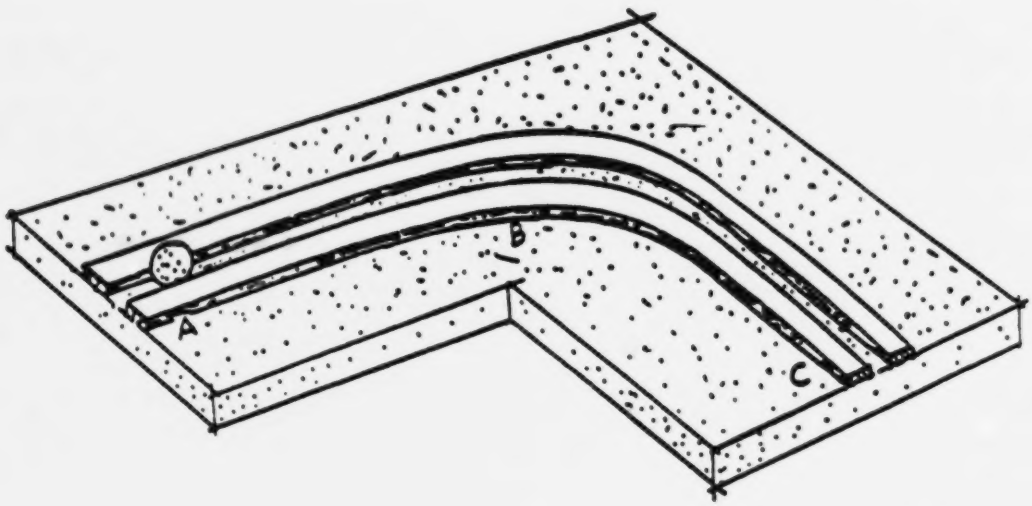


Figure 2 - One solution to the Point A to Point C through Point B assignment

Design a guidance system which will cause the vehicle to move from Point A to Point D passing through Point B and being lowered from Point C to Point D without a free fall. Points A, B, and C are located on a table or bench with Point C at the edge and Point D is on the floor directly below Point C. Figure 3 shows a solution for this design solution.

3. Have the student solve each problem using available materials. Stress the need for guidance as one of the basic elements in a transportation system.

4. Have the groups demonstrate their solutions to the class.

5. Discuss each solution in terms of efficiency, creativity, etc.

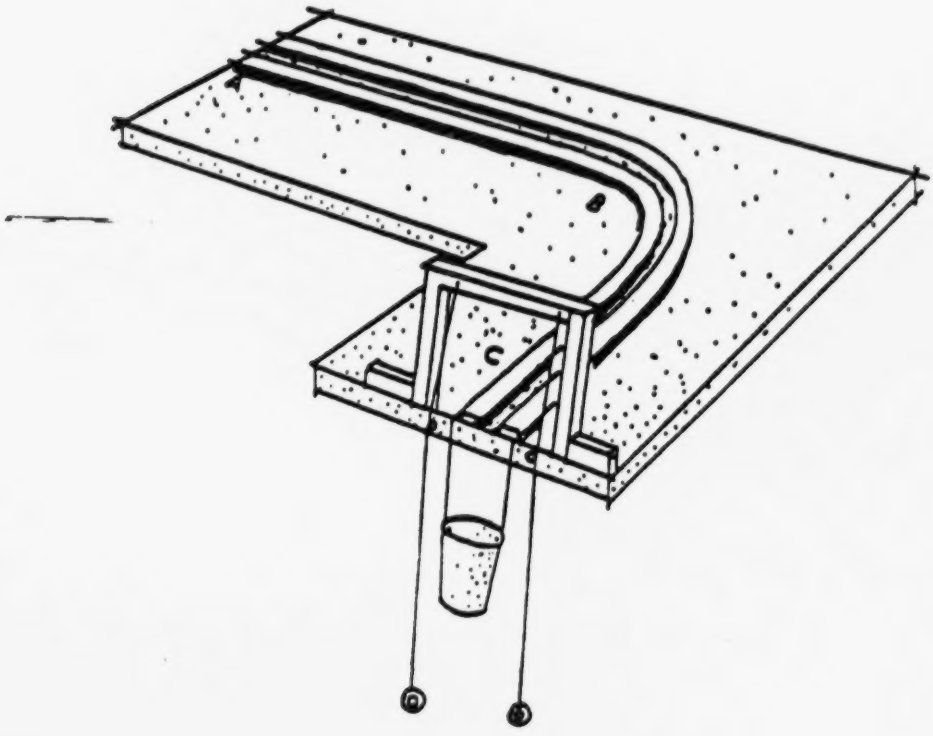


Figure 3: One solution for the Point A to Point D design assignment

Equipment and Supplies:

- Golf ball (vehicle)
- Assorted materials:
  a. cardboard
  b. string
  c. dowels
  d. masking tape
  e. wood strips
  f. wire
  g. metal cans
  h. plastic bottles, etc.
- Common cutting tools:
  a. knives
  b. scissors
  c. tin snips, etc.
- Clamps, etc.

MODULE: 2 : Transportation Systems

LENGTH: 12 DAYS Transportation CLUSTER

Technology is described as the use of tools, machines, and systems to extend the potential of people to control the natural and human-made environments. All systems have a common structure. They have a set of inputs which are changed by a series of processes into a desired output. Also, all systems have internal goals and external constraints.

Transportation systems are no different from any other system. They use energy as the primary resource which is supplemented by human, natural, capital, and financial resources. These resources are applied to the act (process) of transporting people or goods from one location to another using a vehicle and/or a container. When the system is applied to the industrial setting, a transportation enterprise has the goal to relocate people and goods for a profit. Societal demands regulate the freedom (constrains) the enterprise has in reaching this goal.

Most transportation systems use a vehicle of some type. These vehicles have five major systems and require a support system. These systems are described as follows:

1. Propulsion - a method to power the vehicle.
2. Suspension - a method to smooth the ride for the cargo or the passenger.
3. Structure - a framework to support the other systems and protect the passengers and/or cargo.
4. Guidance - a method to determine the path the vehicle is taking.
5. Control - a method of accelerating, deceleration, and changing the direction and/or altitude of the vehicle.
6. Support - systems which provide data (navigational, directions, etc.), fuel, pathways (roads, airways), terminals, etc.

This module is designed to introduce students to the basic features of transportation systems and vehicular subsystems.

OBJECTIVES

Upon completing this learning module, each student should be able to:

1. Describe and explain transportation as a system.
2. List and describe the inputs to the transportation system.
3. List and describe the processes used by transportation systems.
4. List and describe the outputs of transportation systems.
5. List and describe the goals of a transportation enterprise.
6. List and describe the constraints placed on industries operating transportation systems by individuals and society through government regulation.
7. List the five essential systems contained in each transportation vehicle.
8. List and describe the types of support systems needed to operate a transportation vehicle or system.
9. Differentiate between guidance and control.
10. Differentiate between roadways, guideways, and waterways.
11. Describe the major transportation system management activities.

CALENDAR

DAY	ACTIVITY
1	Discuss Transportation as a System. Show a film on transportation. OR Invite a speaker on transportation.
2	Discuss the essential elements in a vehicle. Introduce a transportation activity.
3	Introduce use of hand tools and basic machines.
4-6	Supervise the students as they work on the transportation activity.
7	Discuss managing a transportation system.
8-11	Supervise the students as they work on the transportation activity.
12	Summarize module.

PRESENTING THE MODULE

DAY	ACTIVITY
0	Before introducing this module the following tasks should be completed: 1. Select and order a film which can be used to reinforce the discussion of transportation as a system. It should show: a. Inputs (natural—fuel, people, capital—vehicles, terminals, people, knowledge, and finances), processes (moving people and goods and managing activities, and outputs) b. Vehicles and their systems c. Regulation from government. 2. Develop an activity for the module such as: (more complex than the activity in Module 1) a. Design and construct a model of a canal transportation system b. Design a transportation system which will move styrofoam packing beads from Point A to Point B c. Design and construct a model of a transportation system to move people from a check-in counter to an airplane which is 1/4 mile away. 3. Invite a speaker to discuss transportation systems with the class. The manager of the city bus system, a trucking company, etc. could provide the necessary expertise. Have the speaker discuss routes, passenger and/or cargo considerations, vehicles, and management activities.
1	Introduce transportation as a system through a presentation. Emphasize the inputs, process, and outputs of the system; managerial and transporting processes; goals and regulations. Show a film which depicts transportation as a system. Use the film to reinforce the discussion.

DAY	ACTIVITY
2	Discuss the essential systems found in vehicles—propulsion, structure, guidance, control, and suspension. Have the class view slides of various vehicles (boats, cars, trains, planes, spaceships), and through a worksheet and/or a discussion, list the type of system each vehicle uses; i.e. type of propulsion system type of guidance system, etc. (See Appendix for sample work sheet.) Divide the class into groups of 3-5 students. Introduce the class to the transportation activity or activities that will be used with this module. You may have each group work on the same problem or have a separate problem for each group. Assign or have the group select a leader for each group.

SCHOOL
Name:
Type of vehicle:
Describe the system used in the vehicle:
Propulsion:
Structure:
Guidance:
Control:
Suspension:

B

DAY	ACTIVITY
3	Demonstrate the simple tools and machines the class will be using with this assignment—hot wire cutter for styrofoam, X-acto knives, hot glue guns, scroll saw, disc sander, etc. STRESS SAFETY!!!! Keep the demonstrations simple. The student needs to be shown safe use of the tools and machines. HOWEVER, the goal of this activity is to study transportation NOT learn lists of tool names and their parts.

DAY	ACTIVITY
4-6	Supervise and assist the students as they work on the transportation activity assigned to the group. Demonstrate additional tools and machines as needed.
7	Discuss managing a transportation system emphasizing the planning, organizing, directing and controlling activities required to operate an enterprise which specializes in providing transportation services. Include the activities of preparing to move people or cargo, the act of moving, and completing the move. Discuss receiving, loading, moving, and unloading. Differentiate between the type of activities used with people and cargo.
8-11	Supervise and assist the students as they work on the transportation activity assigned to the group.
12	Summarize the module by having the students present the results of their transportation activity. Tie their work with the content of the module.

APPENDIX

Name _____ Class _____

Directions: Name the structure, propulsion, guidance, suspension, control, and support systems for each of the following different types of transportation vehicles.

	Diesel train engine	
structure		suspension
propulsion		control
guidance		support
	Ford pickup truck	
structure		suspension
propulsion		control
guidance		support
	Radio-controlled boat	
structure		suspension
propulsion		control
guidance		support
	Boeing 747 airplane	
structure		suspension
propulsion		control
guidance		support
	River paddle boat	
structure		suspension
propulsion		control
guidance		support
	Army tank	
structure		suspension
propulsion		control
guidance		support

BIBLIOGRAPHY

TEXTBOOKS

Bohn, Ralph C., et.al., Energy, Power and Transportation.
Bennett and McKnight Publishing Co., 1986, pp. 173 - 184.

Karwarka, Dennis and Michael R. Kozak, Energy, Power and Transportation.
Harcourt Brace Jovanovick, Publishers, 1987, pp. 226 - 237.

INTRODUCTION

MODULE: 3 : Land Transportation Systems

LENGTH: 4 DAYS Transportation CLUSTER

Transportation systems are designed to operate in specific environments. Different systems are designed to move people and cargo on land and water and in air and space. The systems most familiar to people are land transportation systems. These are used or operated by almost every citizen.

The common land transportation systems are:
1. Highway transportation systems
2. Rail transportation systems
3. Pipelines.

Highway systems move people and cargo using cars and trucks that usually travel on fixed roadways. Rail systems use vehicles that travel on both monorail and two-track (railroad, subway) railways. Pipelines move liquids and slurries from mines and wells to manufacturing and processing plants and on to final customers. Most homes are connected to pipelines that deliver water and natural gas, and remove waste.

This learning module will allow the students to study the three major land transportation systems and the vehicles they use. Laboratory activities will permit the students to have experience in designing vehicles for highway and/or railroad systems and may include experiences in pipelines.

OBJECTIVES

Upon completing this learning module, each student should be able to:

1. List and describe the three major types of land transportation systems.

2. Describe the vehicles used to transport people and cargo on rail and highway transportation systems.

3. Describe the facilities used for land transportation systems.

4. Differentiate between people and cargo-moving vehicles.

5. Discuss the impacts of land transportation systems on people and the society.

PRESENTING THE MODULE

DAY	ACTIVITY
1	Introduce the students to land transportation.
	Show a film on land transportation.
2	Discuss highway transportation including routes and facilities.
	Present land transportation laboratory activity.
3-5	Demonstrate tools and machines to be used with the activity.
	Supervise students as they work on the land transportation assignment.
6-7	Discuss rail and pipeline transportation assignment and land transportation routing/cost assignment.
8-10	Supervise students as they work on their land transportation assignment.
11	Have the students present the models of the transportation systems emphasizing the vehicle, pathway, and cargo/passenger compartment.
	Summarize module

DAY	ACTIVITY
0	Well before this module is introduced, the following tasks should be completed.

1. Select a film on land transportation that shows both the vehicles and the support facilities (roads, terminals, etc.).

2. Develop one or more land transportation assignments such as:

   a. Develop a vehicle which will carry two table tennis balls (a driver and a passenger) the length of a monorail constructed of 3/4" or 1" flexible PVC pipe.

      NOTE: This assignment will require prior construction of the monorail.

   b. Develop a vehicle, powered by a mousetrap, which will carry two table tennis balls (a driver and a passenger) at least 10" and stay on a 24" wide roadway.

      NOTE: Tape off a 24" wide area of floor to simulate the roadway.

   c. Develop a pipeline system which will carry styrofoam packing "peanuts" the length of a 1" diameter PVC pipeline which has at least two curves and one change in elevation.

      NOTE: The pipeline should be built before the assignment is started. Compressed air can be used to cause the material to move down the pipeline.

3. Collect an assortment of materials that students can use to complete the assignment.

4. Obtain roadmaps for highway route laboratory assignment-Day 6-7.

1 Present a discussion on land transportation. This presentation should be a general introduction to the major types of land transportation (highway, railroad, pipeline, and off-road), and the routes and facilities they use. Later, discussions will provide more specific information of highway, rail, and pipeline systems.

Show a film on land transportation.

DAY	ACTIVITY
2	Present a discussion on highway transportation. Emphasize the vehicles used to move people and cargo. Differentiate between the requirements for moving people and cargo; i.e. comfort, protection, ease of loading, etc. Present a description of types of roadways, terminals, etc. Discuss the difference between personal (cars), and mass transit (buses), and between private and for-profit (a business enterprise), transportation. Include in the presentation a discussion of highway routes and facilities. Present the types of roads, (tool, interstate, primary, secondary, etc.), and the terminals, (bus, truck), used. (The total discussion should be limited to 20-25 minutes.) Present the land transportation assignment to the class. Divide the class into groups of 2-4 (or they can work alone). Each group can have the same assignment, or better still, different assignments. If different assignments are used, develop highway, rail, and pipeline assignments. The groups will have about seven class periods to do the assignment.
3-5	Demonstrate the major tools and machines the students will use in completing the assignment. Special tools and machines can be demonstrated on a "need-to-know" basis. Short demonstrations may be spaced over several days. Again, remember that SAFE use of tools is the goal; NOT tool names, processing information, etc. Most of these days should be given to student groups working on their assignments.

DAY	ACTIVITY

6-7 Discuss railroad transportation. Present the types of rail systems (freight and passenger), and the major types of engines and cars used. Discuss rail route and facilities. Integrate the discussion with a presentation on pipeline systems. Present the types of pipelines and the products they carry (raw materials and finished products; liquids, gases, slurries). Discuss the various routes for pipelines using slides or maps. (NOTE: Both systems are basically freight-carrying systems.)

Show a film on pipelines.

Divide the class into groups of 2-3 students. Introduce and have the students complete a land transportation system route assignment such as:

"You are planning to take a cross-country trip to (destination). Select a route, then list the things that can be seen or done along the way. Calculate the cost of the trip using the following base costs.

Automobile	$ .25	per mile
Meals	$10.00	per day per person
Lodging	$35.00	double
.....	$ 5.00	each extra
Miscellaneous	$20.00	per day

Compare the cost for personal travel with mass land transit (bus and rail). Your teacher will have the cost of tickets on the bus and train."

NOTE: Maps and tour guides (AAA, Mobil, etc.) will be needed for this assignment.

"You are the dispatcher for a household moving company. One truck has a load to be moved from Los Angeles to Duluth, Minnesota. Plan a route with consideration for mountains, two-lane roads, etc. which will slow the truck down."

NOTE: Maps are needed for this assignment.

DAY	ACTIVITY
	"Using a map of rail lines in the United States, plot a route for a shipment from Portland, Oregon to New Orleans."
	"Using a model railroad, simulate the movement, switching of cars, and other railroad activities."
8-10	Supervise students as they work on their major land transportation assignment (model).
11	Summarize the module with student reports on their transportation models. Tie in the models with the content of the module.

BIBLIOGRAPHY

Bohn, Ralph C., et.al., Energy, Power and Transportation. Bennett and McKnight Publishing Co., 1986, pp. 186-209, 236-240.

DeOld, Alan R., Everett Sheets, and Alexander, Williams., Transportation. Davis Publications, Inc., 1986, pp. 27-186.

Karwarka, Dennis and Michael R. Kozak, Energy, Power and Transportation. Harcourt Brace Jovanovick, Publishers, 1987, pp. 238-255, 300-307.

FILMS

Altered Environment Series: An Inquiry into the American Highway

10 Minutes Film # 03555 Rental: $10.00

Presents the role of the modern highway in the American way of life and its effect on the environment.

Available from the University of Illinois Film Service,
1325 South Oak Street, Champaign, IL 61820
(800) 252-1357

Donald and the Wheel

14 Minutes Film # 54489 Rental: $13.50

Donald Duck is shown as the inventor of the wheel and then he travels through the history of wheeled transportation from prehistoric days to modern time.

MODULE: 4 : Water Transportation Systems

LENGTH: 10 DAYS Transportation CLUSTER

Water transportation is among the oldest methods of transportation. Fairly heavy loads were moved on water long before an adequate road system was developed. The power of nations in early times was often measured by the strength of its navy and the extent of its water bound trade.

The opening of the new world was possible only after fairly sophisticated water transportation systems, with their means of navigation, were developed.

Water transportation systems can be divided into two major types:

1. Marine Transportation: The movement of people and cargo on the oceans and seas.

2. Inland Waterway Transportation: Movement of people and cargo on the lakes and rivers of a country.

Marine transportation generally uses larger ships while inland waterway transportation uses smaller ships, barges, tugboats, and ferryboats.

Personal water transportation is almost totally limited to inland waterways where people use a wide variety of crafts from speedboats, to hydrofoils, to houseboats.

This module is designed to introduce students to the basic concepts of water transportation and is supported by selected laboratory activities.

OBJECTIVES

Upon completing this learning module, each student should be able to:

1. Describe water transportation.
2. Differentiate between marine and inland waterway transportation.
3. Describe the basic vessels used by water transportation systems.
4. List major waterways in the United States and the World.
5. List the advantages and limitations of water transportation.

CALENDAR

DAY	ACTIVITY
1-2	Introduce water transportation. Show a film on water transportation. Introduce and have the students start the major laboratory activity for water transportation.
3-4	Supervise students working on the laboratory activity.
5-6	Discuss water transportation, vessels, and waterways. Supervise students working on the laboratory equipment.
7	Present and have student complete waterway routing assignment.
8	Supervise students working on the laboratory activity.
9	Summarize module.

PRESENTING THE MODULE

DAY	ACTIVITY
0	Before introducing this learning module the following tasks should be completed: 1. Select a film that introduces the basic concepts of water transportation including vessels and waterways. 2. Develop a major laboratory activity such as: a. Design and construct a barge which will carry a load of 2# through a 6" wide channel with a 3" draft. b. Construct a model of a canal lock. c. Construct a model of a canal which has the three basic features: - a way to change elevations (lock), - a way to cross narrow, low areas, such as streams (aqueducts), and - a source of a constant water supply (reservoir with a dam). d. Construct and test a model of a shipping container for ocean transportation. The container should be able to: - be easily loaded and unloaded, - keep a raw egg from breaking in a 10' drop, - keep the cargo dry under wet weather, and - be able to be loaded and stacked on a ship (flat surface) with a crane.
1-2	Present an introduction to water transportation which discusses vessels, terminals, routes, and major waterways in general terms. Vessels and waterways will be presented in more detail later. Also, present the advantages and limitations of water transportation. (This presentation should not exceed 20 minutes.) Show a film on water transportation. Introduce the major laboratory activity developed for this module. Divide the class into groups and have them start work on the models. Present any demonstrations needed to complete the activity. STRESS SAFETY!!!

DAY	ACTIVITY
3–4	Supervise the students as they work on their laboratory assignments.
5–6	Present a discussion on water transportation vessels and waterways. Discuss the major types of vessels used for both marine and inland waterway transportation. Also differentiate between cargo and passenger (cruise) ships. (This discussion should not exceed 20 minutes.) Supervise the students as they work on their laboratory assignments.
7	Present and have students complete a waterway assignment such as: "You are a tour director. Plan a two-week cruise with major ports-of-call." NOTE: You will need to gather maps showing major ports in the world and lists of the approximate sailing times between major ports in the world. Travel agents have information on scheduled cruises from which you can estimate approximate sailing times.
8	Supervise the students as they work on their laboratory assignments.
9	Summarize the module by having the students present the models. Tie their presentations to the content of the module.

BIBLIOGRAPHY

TEXTBOOKS

Bohn, Ralph C., et.al., Energy, Power and Transportation.
Bennett and McKnight Publishing Co., 1986, pp. 223-235.

DeOld, Alan R., Everett, Sheets, and William, Alexander, Transportation.
Davis Publications, Inc., 1986, pp. 187-280.

Karwarka, Dennis and Michael R. Kozak, Energy, Power and Transportation.
Harcourt Brace Jovanovick, Publishers, 1987, pp. 256-268.

FILMS

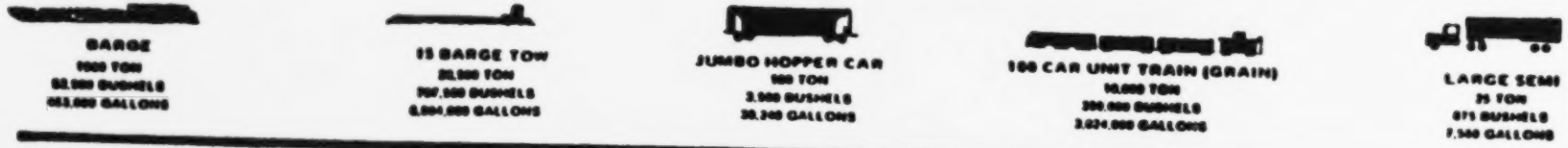
Saga of the Erie Canal!

11 Minutes Film # 80838 Rental: $10.00

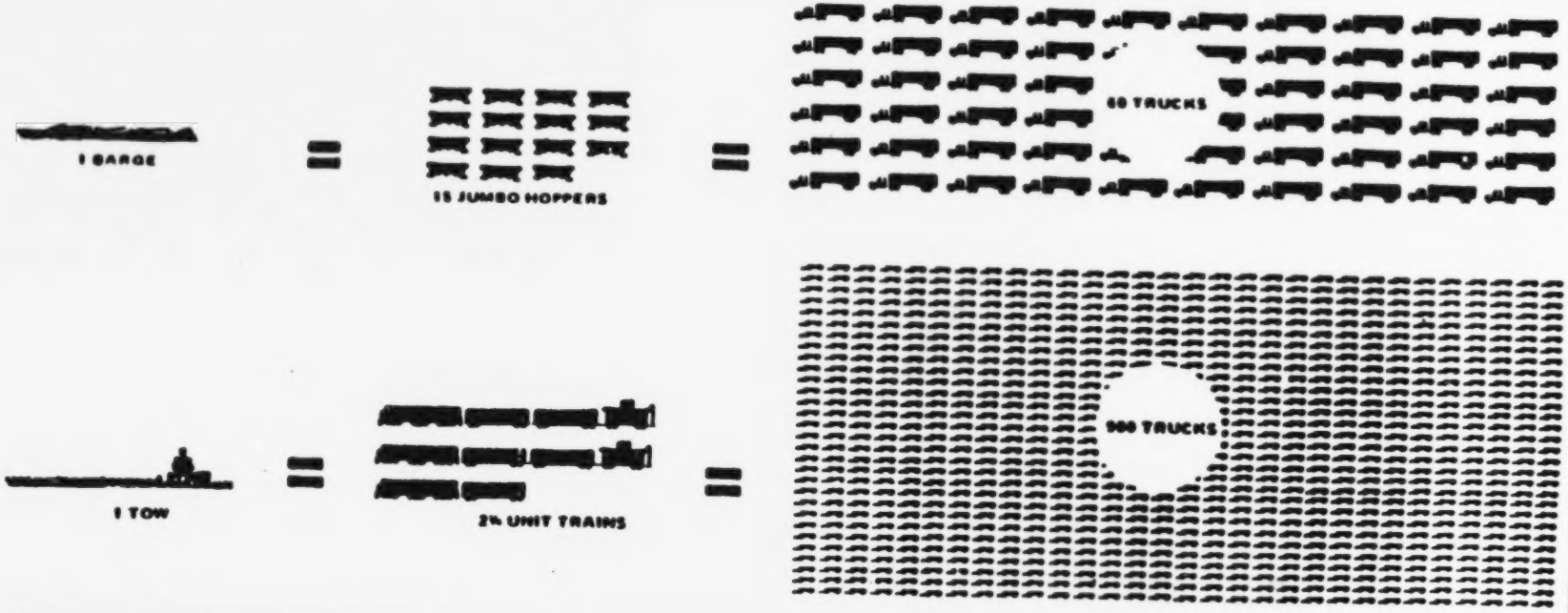
Visualizes the construction of the Erie Canal as one of the great engineering feats of the United States.

Available from the University of Illinois Film Service,
1325 South Oak Street, Champaign, IL 61820
(800) 252-1357

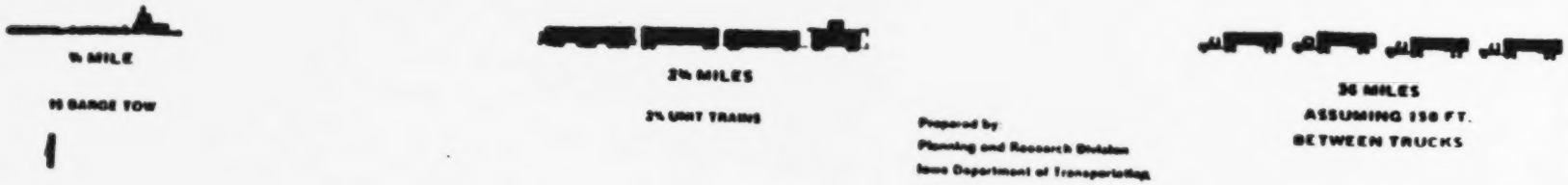
CARGO CAPACITY



EQUIVALENT UNITS



EQUIVALENT LENGTHS



Prepared by
Planning and Research Division
Iowa Department of Transportation

APPENDIX

INTRODUCTION TO TRANSPORTATION TECHNOLOGY

MODULE: 5 : Air Transportation Systems

LENGTH: 10 DAYS Transportation CLUSTER

Air travel is a recent phenomenon in the history of transportation. While land and water transportation can be traced back thousands of years, air transportation is a 20th century development. However, its importance has been growing rapidly since the end of World War II.

Originally, air transportation was the purview of the rich. Early airliners seated but a handful of passengers, were noisy, and slow. Now, modern jets wing hundreds of common folk across thousands of miles in quiet comfort.

To support this type of travel, elaborate guidance systems have been developed to make air travel one of the safest modes of transportation available.

This module will introduce students to aircraft, flight paths, terminals, and guidance systems used in air transportation. Laboratory activities will help make this introduction more meaningful for the students.

OBJECTIVES

Upon completing this learning module, each student should be able to:

1. Define and describe air transportation.
2. Identify the major types of craft used for air transportation.
3. Describe the methods used to guide aircraft along flight paths.
4. Describe the support systems used in air transportation.
5. List the advantages and limitations to air transportation.

CALENDAR

DAY	ACTIVITY
1-2	Introduce air transportation.
	Show a film on air transportation.
	Introduce laboratory activity for air transportation.
3-5	Provide demonstrations needed for the laboratory activity.
	Supervise work on laboratory activity.
6-7	Present a discussion of flight paths, routes, and airport terminals.
	Present flight path and route or airport assignment.
8-9	Supervise work on laboratory activity.
10	Summarize the module.

DAY	ACTIVITY
0	Well before introducing this module, the following tasks should be completed: 1. Order a film to introduce air transportation. 2. Develop a laboratory activity for air transportation, such as: a. Make a model of a hot air balloon (blow up a 6" diameter balloon. Cut elliptical sections of tissue paper which are about three times as long as they are wide, and long enough to extend from the top to the bottom of the balloon. Place the tissue sheet over the balloon carefully, overlapping the seams by about 1/4". Glue the seams. Place a 1" collar at the open end, then deflate the balloon. Fill the balloon with hot air through a tin can with its ends removed — that is placed over a hot plate.) b. Build a model of dirigible. (Tie lengths of 3/16 reeds or similar materials together. Glue balsa wood ribs around the football-shaped form produced by the reeds. Cover with tissue paper soaked in diluted polyvinyl glue, and let dry. Insert an empty balloon in the form and fill with helium. Tether with strings.) c. Build a model of a glider. d. Build a model of an airliner or other plane.
1-2	Present a discussion on air transportation. This presentation should be a general introduction to the area, with a more specific introduction to aircraft. The types of planes (cargo, passenger), and their power plants (piston, turboprop, jet), should be emphasized. Also, discuss the evolution of air transportation from a rich man's mode of transportation to an affordable means of travel. (This discussion should not exceed 20 minutes.) Show a film to reinforce the discussion. Introduce the laboratory activity or activities to the class. Divide the class into groups of 2-3 to work on the assignment. A different activity may be assigned each group to cover more types of aircraft. Encourage them to do outside research on the problems they are assigned.

DAY	ACTIVITY
3	Demonstrate any new machines or tools that the students will be using. **STRESS SAFETY!!!** Supervise the students as they begin work on their laboratory assignment.
4-5	Supervise the students as they continue to work on their major laboratory assignment.
6-7	Present a discussion on flight paths and routes. Use maps or slides of maps to show the various airline routes. Discuss the hub and spoke system used by many airlines and freight companies (i.e. Federal Express at Memphis, United Airlines at Chicago and Denver, etc.). Integrate this presentation with a discussion on terminals and support systems. Discuss terminal requirements for: 1. Access and parking. 2. Ticketing and baggage handling. 3. Passenger concourses and loading ramps. 4. Ground support. Also, discuss navigational support systems. (This discussion should not exceed 20 minutes.) Introduce and have the students complete either a: 1. Laboratory assignment on airline routes such as:

SCHOOL

Name:

Using the flight maps provided, list the airlines that you could use to travel on the following routes. Place a (+) after the airline if it flies nonstop on the route, and (-) if it flies through a hub. NOTE: Some airlines will have both a (+) and a (-).

Chicago-Denver	Indianapolis-Orlando
New York-Boston	Washington D.C. - San Francisco
Los Angeles-Seattle	

NOTE: To use this assignment you will need route maps from a different airline.

DAY	ACTIVITY
	2. Laboratory assignment on airport layout in which the students sketch a layout for a terminal for two airlines and two loading ramps. They should consider: a. arriving passengers b. departing passengers c. ticketing counters d. gate check-in e. baggage check-in f. baggage claim area g. auto parking h. bus and taxi service, etc.
	OPTIONAL Invite a speaker from the local airport to speak on flying, navigation, air traffic control, etc.
8-9	Supervise the students as they work on their major laboratory assignments.
10	Summarize the module by having the students present their laboratory activities. Tie their presentations to the content of the module.

BIBLIOGRAPHY

Bohn, Ralph C., et.al., Energy, Power and Transportation.
Bennett and McKnight Publishing Co., 1986, pp. 210 - 222.

DeOld, Alan R., Everett Sheets, and William Alexander, Transportation.
Davis Publications, Inc., 1986, pp. 281 - 382.

Karwarka, Dennis and Kozak, Michael R., Energy, Power and Transportation.
Harcourt, Brace Jovanovick, Publishers, 1987, pp. 269-286.

FILMS

Airplane Trip by Jet (Third Edition)

11 Minutes Film # 2700 Rental: $8.00

Shows aircraft operation. Views how management, flight crews, and ground crews communicate. Describes aircraft maintenance.

Airplanes and How They Fly (Revised Edition)

11 Minutes Film # 5815 Rental: $10.50

Explains the principles of launching, flying, and controlling aircraft. Explains gravity, lift, drag, and thrust.

Available from: Bureau of Audio Visual Instruction,
University of Wisconsin Extension
1327 University Avenue, Madison, WI 53706
(608) 262-1644

America's Wings

28 Minutes Film # HQa 267 Free

Deals with the ideas and inventors who contributed to the evolution of air transportation.

Available from: NASA Lewis Research Center,
Office of Educational Services
21000 Brookpark Road, Cleveland, OH 44135
(215) 433-4000, Ext. 708

MODULE: 6 : Space Transportation Systems

LENGTH: 10 DAYS Transportation CLUSTER

Space transportation today is in its infancy as was air transportation in the early 1900's. Almost daily, we gain new information about the desirability and feasibility of general space travel. Until recently, only highly trained astronauts could venture into space. Now, the space shuttle is taking the common citizen along.

Additionally, unmanned space probes are reaching the outer limits of our solar system and will move on into the deep reaches of space.

This module is designed to help students better understand space travel which they read and hear about constantly.

OBJECTIVES

Upon completion of this learning module, each student should be able to:

1. Define and describe space travel.
2. List and describe major space travel vehicles and power systems.
3. Explain how a rocket provides propulsion.
4. Describe space navigation techniques.
5. Describe the benefits and limitations to space travel.
6. Describe the "spin-offs" or products coming from space research.

CALENDAR

DAY	ACTIVITY
1	Introduce space travel.
	Show a general film on space travel.
2–4	Introduce major laboratory activity.
	Demonstrate any new tools and machines used with the laboratory activity.
	Supervise students on their laboratory activity.
5	Discuss rockets and their operation.
	Show a film on rockets.
6–8	Supervise students on their laboratory activity.
9	Launch rockets (laboratory activity).
10	Summarize the module.
	Show summary film.

PRESENTING THE MODULE

DAY	ACTIVITY
0	Well before introducing this module, the following tasks should be completed: 1. Order films for Days 1, 5, and 10. The film for Day 1 should be a general space travel film. The Day 5 film should concentrate on rockets, while the Day 10 film can be either a general film, or provide a view of future space travel. 2. Develop a laboratory activity in which the students build and launch a rocket. Information may be obtained from a hobby store or the IACP. Activity for building a rocket is included at the end of this activity. (This activity is now in the public domain and can be reproduced for class use.)
1	Present a discussion of general space travel. Many books on the subject are available in libraries. Present both manned and unmanned space shots. Discuss the goals of the missions and the information gathered. Also, introduce students to the products that have resulted from space research. Show a film of general space travel.
2-4	Introduce the laboratory activity — building a rocket. (See Appendix.) "In groups of 3-5, construct a rocket which can be launched and recovered." 1. Divide the class into groups 2. Select a leader 3. Assign tasks within the group 4. Complete tasks Demonstrate building the rocket and supervise the students' work as they: 1. Build body 2. Fabricate nose cone.

DAY	ACTIVITY
5	Present a discussion and show a film on rockets and their operation. Trace the evolution of rockets from Goddard's work to the present.
6-8	Supervise the students' work on the rockets as they: 1. Fabricate and attach fins 2. Fabricate engine mount 3. Fabricate parachute 4. Assemble rocket.
9	Launch the rockets—exercise extreme caution during this activity.
10	Summarize the module. Show a summary film.

BIBLIOGRAPHY

TEXTBOOKS

Karwarka, Dennis and Michael R. Kozak, Energy, Power and Transportation. Harcourt Brace Jovanovick, Publishers, 1987, pp. 287-299.

DeOld, Alan R., Everett, Sheets, and William, Alexander, Transportation. Davis Publications, Inc., 1986, pp. 383 -454.

FILMS

Blue Planet

10 1/2 Minutes Film # HQ 224 Rental: Free

An overview of the space program featuring highlights of America's role in space exploration.

Eagle Had Landed: ;Flight of Apollo 11

28 1/2 Minutes Film # HQ 194 Rental: Free

The story of the historic first landing on the moon in July, 1969.

Portrait of Earth

27 Minutes Film # HQ 299 Rental: Free

Explains satellites—what they are and how they perform their daily tasks in orbit around earth.

Space Navigation

21 Minutes Film # HQ 116 Rental: Free

Explains in non-technical terms the mathematical principles of charting a course in space.

Films available from:
NASA Lewis Research Center
Office of Educational Services
21000 Brookpark Road, Cleveland, OH 44135
(216) 433-4000, Ext. 708
(Order at least 45 days in advance. Film catalog also available.)

APPENDIX

Complete directions for constructing a model rocket may be found in the IACP manufacturing laboratory manual, or kits with directions may be purchased from: PITSCO, P.O. Box 1328, Pittsburg, KS 66762

NOTE: You may also want to check with your local hobby store for rocket kits and supplies.

Caution should be exercised to insure that the kits require sufficient student activity.

MODULE: 7 : Energy Systems

LENGTH: 20 DAYS Transportation CLUSTER

All transportation systems have energy as a major input. Energy provides the power to move people and cargo from one place to another. Over the years, a variety of energy sources have been developed to power vehicles. The power of animals, flowing water, and wind, were first used. Later, heat engines converted the energy in coal, wood, and oil, into power to move water and land vehicles. Solar and nuclear power was developed in more recent years to power ships and spacecraft.

A study of transportation would not be complete without an investigation into the various sources of the energy which drive the vehicles in the system. Likewise, energy utilization is not limited to transportation systems. Energy is a vital input to all technological systems—communication, construction, manufacturing, and transportation.

This module will introduce students to energy systems and their inputs, processes, and outputs. Sources on energy, types of energy, energy conversion and utilization, and measurement of power and energy, will all be addressed through presentations and laboratory activities. Finally, a view of energy and its impact on the environment will be provided.

OBJECTIVES

Upon completion of this learning module, each student should be able to:

1. Define energy.
2. Differentiate between energy and power.
3. List and describe the sources of energy.
4. List and define the types of energy.
5. Describe energy utilization as a system with input, processes, and output.
6. Describe the operation of common energy utilization systems.
7. Describe the steps in energy utilization.
8. Discuss the impacts of energy on individuals, society, and the environment.
9. Measure energy and power utilization.

CALENDAR

DAY	ACTIVITY
1-2	Introduce energy as a system.
	Show a film introducing energy.
	Discuss sources of energy.
	Assign sources of energy worksheet.
3	Present sources of energy laboratory assignment.
4-6	Supervise students' work.
7	Have students present energy sources model or display.
8	Discuss types of energy.
	Present developing an energy system laboratory activity.
9-10	Supervise students' work.
11	Discuss engines as an energy converter.
	Show a film on the engines.
12	Supervise students' work.
13	Have students present types of energy models.
14	Discuss advanced energy systems (solar-nuclear).
	Show film on solar or nuclear power.
	Introduce laboratory activity for solar power.
15-17	Supervise students' work.
18	Discuss energy and the environment.
	Show a film of energy and the environment.
19	Introduce energy and the environment worksheet.
20	Summarize the module.

PRESENTING THE MODULE

DAY	ACTIVITY
0	Well before introducing this module, the following tasks should be completed: 1. Select and order films for Day 1, 7, 14, 19, and 24. 2. Develop worksheets for the films. 3. Develop a laboratory activity on sources of energy. 4. Develop an activity on developing an energy system. 5. Develop a laboratory activity on solar energy. 6. Develop worksheets on measuring energy useage. 7. Develop a worksheet on energy and the environment.
1-2	Present a discussion on energy as a system. Stress the inputs, processes, and outputs of the system along with the goals and environmental impacts. Present the concepts that energy is converted from one form to another (i.e. mechanical to electrical in a generator; light to heat in a solar cell, etc.); that the energy is transmitted (over wires, through a transmission and drive train, etc.); and energy is applied to work (heat or light a home, move a cargo, etc.). Show a film on energy systems. Introduce, show, and review the film. Discuss the sources of energy. Differentiate between exhaustible, renewable, and inexhaustible sources. Give examples.

DAY	ACTIVITY

Distribute and explain sources of energy assignment.

Individually, or in groups of 2-3 students, complete a worksheet on sources of energy, such as:

SCHOOL

Name:

List the possible sources of energy for each of the following devices:

Electric lights:

Automobiles:

Aircraft:

Ships:

Heating system for a building:

Telephone:

3 Present a source on energy laboratory activity such as:

1. As a member of a group of 2-4 students, design and build a model or display that shows a form of energy. The assignment might be:

   a. Research, design, and construct a model that would show mechanical energy.
   b. Other assignments would show electrical, nuclear, light, chemical, or heat energy.
   c. Demonstrate new tools and machines the student will be using to complete the laboratory activity.

DAY	ACTIVITY
4-5	Supervise the students' laboratory activity.
7	Have the students present their model.
8	Discuss types of energy (mechanical, electrical, light, heat, chemical, and nuclear). Differentiate between potential and kinetic energy. (Limit the discussion to 15 minutes maximum.) Present a developing an energy system laboratory activity such as: - As a group of 2-4 students, design and construct a model that will show a complete energy system including the input, energy conversion process, and the device operated by the output. The assignment might read: - "Construct a model which will show the conversion of mechanical energy into electrical energy, (or mechanical to electrical, chemical to electrical, light to heat, heat to electrical, etc.)."
9-10	Have the students start work on the laboratory assignment.
11	Discuss engines as an energy converter. Present the types of internal and external combustion engines. Present the types of motion produced by engines—linear, rotary, and reciprocating. (Limit the discussion to 20 minutes.) Show a film on engines.
12	Supervise the students' work on the laboratory activity.
13	Have students present their models.
14	Discuss advanced energy systems. Present the basic operation principles for solar and nuclear systems. Discuss their advantages and limitations. DO NOT tell students what is RIGHT or WRONG but present a balanced view of the systems. (Limit the discussion to 20-25 minutes.) Show a film on solar or nuclear power. Introduce a laboratory activity on solar power such as: - In a group of 2-4 students, build a model of a solar collector.

DAY	ACTIVITY
15-17	Supervise the students' work on the laboratory activity. Have the students display their models.
18	Discuss energy and the environment. Present the advantages and limitations of various energy systems and their impacts on the environment. Stress that all technological systems are a result of tradeoffs between desired outcomes and negative effects on individuals and the environment. No system is all good or all bad. Show a film of energy and the environment.
19	Assign a worksheet which addresses energy and the environment. An example sheet is as follows:

SCHOOL

Name:

List the advantages and disadvantages of each of the following types of energy. Consider both impacts on our way of life (cost, ease of use, etc.) and the natural environment.

Hydroelectric:

Advantages:

Disadvantages:

Coal:

Advantages:

Disadvantages:

Petroleum:

Advantages:

Disadvantages:

...add others; i.e. nuclear, solar, wood.

20 Summarize the major concepts developed in this module.

BIBLIOGRAPHY

TEXTBOOKS

Bohn, Ralph C., et.al., Energy, Power and Transportation.
Bennett and McKnight Publishing Co., 1986, pp. 11-156, 345-367, 244-290.

Karwarka, Dennis and Kozak, Michael R., Energy, Power and Transportation.
Harcourt Brace Jovanovick, Publishers, 1987, pp. 25-172, 203-224.

FILMS

Films may be borrowed from:

Modern Talking Pictures Service, Film Scheduling Department,
5000 Park Street, North, St. Petersburg, FL 33709

A Gift from the Earth

26 Minutes Free

Examines the various types of geothermal resources and how they can be used.

Coal: Bridge to the Future

28 Minutes Free

Explains how the energy crisis created renewed interest in coal as an energy source.

Coal: The Other Energy

15 Minutes Free

Examines the role of coal in America's energy future.

Energy 2000

25 Minutes Free

Examines various sources of alternate energy that might one day replace oil.

Energy for the 80's

27 Minutes Free

A look at energy alternatives in the United States.

BIBLIOGRAPHY

Energy—the American Experience

28 1/2 Minutes Free

Shows the development of different forms of energy in America over the past 200 years.

Gusts of Power

14 Minutes Free

Shows that we use only a fraction of the potential energy of the wind.

Nuclear Energy—Power for Today and Tomorrow

28 Minute Free

Shows how nuclear energy has the potential for becoming the next major source of energy.

Producing Oil

28 Minutes Free

Gives a basic explanation of what is required to get oil and gas out of a reservoir and to the pipeline.

Up the Power Curve

16 Minutes Free

Shows the practicality of energy conservation and its role in solving America's energy problem.

U.S. Department of Energy Film Library
P. O. Box 62, Oak Ridge, TN 37830

MODULE: 8 : Transportation and Society

LENGTH: 3 DAYS Transportation CLUSTER

The impact and future of transportation should be of great concern of each citizen. As the world shrinks with ever faster modes of transport, we are drawn closer to cultures different from ours. We are rapidly becoming one society - a world society.

Transportation vehicles have given us great freedom to roam the world but have also caused air, water, and noise pollution. Each of the problems must be faced.

Also, the power sources for our transportation vehicles is ever changing, from animals, to coal-fired steam engines, to internal combustion engines, to jet engines, to liquid and solid fuel rockets.

This module is designed to summarize this course and cause the student to synthesize their thoughts of the positive and negative impacts of transportation on their lives.

OBJECTIVES

Upon completing this module, each student should be able to:

1. Identify impacts of transportation on individuals and society.
2. Analyze the impacts of transportation on individuals and society.
3. Draw conclusions about the impacts of transportation on individuals and society.

CALENDAR

DAY	ACTIVITY
1-2	Lead a discussion on transportation and society.
	Have students complete laboratory sheet.
3	Summarize course.

BIBLIOGRAPHY

TEXTBOOKS

Bohn, Ralph C., et.al., Energy, Power and Transportation. Bennett and McKnight Publishing Co., 1986, pp. 368-376.

DeOld, Alan R., Everett Sheets, and William Alexander, Transportation. Davis Publications, Inc., 1986.

Karwarka, Dennis and Michael R. Kozak, Energy, Power and Transportation. Harcourt Brace Jovanovick, Publishers, 1987, pp. 189-202, 234-237.

DAY	ACTIVITY
0	Before the start of the module, research the major modes of transportation so that you can lead a discussion in which the students can complete the laboratory sheet. The modes may be:

1. Humans walking

2. Animal-drawn vehicles

3. Steam-powered vehicles
   a. trains
   b. ships
   c. cars

4. Internal combustion-powered vehicles
   a. diesel engines (trails)
   b. diesel-powered ships
   c. gasoline-powered cars
   d. propellor aircraft

5. Jet-powered vehicles
   a. ship
   b. planes

6. Rocket-powered craft

PRESENTING THE MODULE

DAY	ACTIVITY
1-2	Lead a discussion which will encourage the class to identify the information needed to complete a chart for each major type of vehicle (1-6). Record the information on butcher paper in a format like the following:

Mode: _____

Time Period When Widely Used: _____

Advantages: _____

Disadvantages: _____

Replaced By: _____

Why?: _____

3 Summarize the course.